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Evaluation of Efficacy of Different Botanicals Against Sugarcane Pokkah Boeng Disease Causing Fungus *Fusarium moniliforme* var *subglutinans* Sheldon

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Abstract Sugarcane crop having great contribution on world's sugar production is an important cash crop in India, but, its cultivation is always adversely affected by the different diseases and Pokkah boeng, an emerging disease, is one of them. For management of the disease eight locally available botanicals were assessed in the laboratory against *Fusarium moniliforme* var *subglutinans* Sheldon,causal agent of Pokkah boeng disease in sugarcane by poisoned food technique. The botanicals used in the study were Margosa (*Azadirachta indica*),Marigold (*Tagetes erecta*) Duranta (*Duranta erecta*), Hibiscus (*Hibiscus* sp.), Cuscuta (*Cuscuta reflexa*), Guava (*Psidium guajava*), Papaya (*Carica papaya*) and Eucalyptus (*Eucalyptus* sp.). All the botanicals significantly inhibited the radial growth of the pathogen. Eucalyptus extract was found most effective to inhibit the growth of pathogen followed by duranta, cuscuta and other botanicals. Hence, they could be employed in large scale farming for control of Pokkah boeng disease of sugarcane.

Keywords Pokkah boeng, *Fusarium moniliforme* var *subglutinans*, Botanicals, Poisoned food technique.

Introduction

Pokkah boeng disease of sugarcane is one of the fungal diseases of the crop which was reported as minor disease in early 1930s. It is the most serious and devastating disease not only in central Uttar Pradesh but also in the whole of the Southern and Northern Sugarcane growing zones of India [1]. Pokkah boeng disease is caused by the fungus *Fusarium moniliforme* var *subgluinans* Sheldon, which reduces the quality of the harvested crop mainly among varieties with high sugar yields and the sugar production is depending upon the variety up to 40.8-64.5 % only [2]. As the management of this soil borne disease through conventional tech-

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nology such as growing resistant varieties, fungicide sett treatment, single treatment of fungicide or bio-agent cannot provide a remedy for disease control [3] a need was felt to develop botanical based bio-fungicides for control of plant diseases. Because non judicious use of synthetic fungicides since last four decades led to several problems to human and animal health besides enviromental problems. this scenario, therefore, calls for alternative approaches which are economically feasible and eco-friendly to increase yield of sugarcane [4]. Recent advances in *Fusarium* sp. control have been achieved through the application of botanical products and antagonistic/ non-pathogenic microorganisms. Crude aqueous extracts of various plants have exhibited some levels of antifungal activity . Such extracts contain active compounds that are biodegradable and are selective in their toxicity. Fungicides are generally used to control of the diseases, however, frequent and indiscriminant use of it leads to ill effects on environment causing soil and water pollution and development of new strain with more virulence, hence Bio-control and Botanicals has been advocated as one of promising alternative strategy to overcome these problems [5]. The present study was conducted to find out effective plant extracts for eco-friendly and economical management of Pokkah boeng disease of sugarcane.

Materials and Methods

The plant parts of certain selected plants supposed to have active antifungal properties were collected from different locations of Pantnagar. Extracts of eight different types of plants as were evaluated against *Fusarium moniliforme* var *subglutinans* following the procedure given by Ansari [6] with a slight modification. Fresh leaves from different plants were thoroughly washed with tap water, then surface sterilized with 2% Sodium hypochloride and successively washed with distilled water. Leaves were then semi dried under shade so that it could be crushed easily. Each sample was then homogenized using (1 : 1 wt/v) sterilized distilled water with a pestle and mortar and squeezed through fine muslin cloth and used as standard plant extract solution. Double strength PDA medium was prepared. The plant extract of desired concentrations (10%, 20% and 30%) were then mixed in double strength PDA medium in separate conical flask and sterilized in autoclave (15 lb p.s.i. for 20 min). This medium (poisoned with plant extract) was poured into sterilized petri plates. In control plate, sterilized water was added instead of plant extracts. Each treatment was replicated thrice along with control. After solidification of the medium, the amended and non-amended agar plates were inoculated centrally with 5 mm discs cut from 7 days old culture by sterilized cork borer. Inoculated petri plates were incubated at 25 ± 2°C and observations on colony diameter (mm) were recorded at every 24 h interval till the check petri plates were fully covered with the growth of the test fungus. This was compared with control to calculate the percentage inhibition of mycelia of the pathogen by Vincent's [7] formula :

$$PI = \frac{C-T}{C} \times 100$$

Where, PI= Inhibition percentage, C = Colony diameter in check plate (mm), T = Colony diameter in treatment (mm).

Results and Discussion

In nature, there are several plants which are known to exhibit anti-fungal properties against various fungi. Present experiment was carried out to evaluate efficacy of plant extracts against Pokkah boeng pathogen. The extracts of eight plants like Neem, Marigold, Hibiscus, Papaya, Guava, Duranta, Cuscuta and Eucalyptus were tested to see their antagonistic effect on pathogen, *Fusarium moniliforme* var *subglutinans* Sheldon, by using Poisoned Food Technique and data are presented in Table 1. The data indicates that increase in per cent inhibition was inversely proportional to the increase in the concentration of the plant extracts.

The data revealed that Eucalyptus, at all the concentrations i.e. 10, 20 and 30% was highly effective in inhibiting the mycelial growth and gave per cent inhibition of 49.44, 55.55 and 58.52%, respectively, as compared to Duranta which gave inhibition of 59.26, 57.96 and 52.61% at all concentrations, although Duranta was showing good inhibition per cent

Table 1. Effect of botanicals on radial growth of *Fusariummonili* forme var *subglutinans.*

Sl. No.	Treatments	Radial growth of fungus (mm) At different concentration 10%	20%	30%	Growth inhibition (%) At different concentration 10%	20%	30%
1	Neem	60.26	66.00	67.68	33.04	26.66	24.80
2	Hibiscus	69.00	67.10	65.88	23.33	25.44	26.80
3	Duranta	36.66	37.83	42.65	59.26	57.96	52.61
4	Marigold	64.00	56.88	56.38	28.88	36.80	37.35
5	Guava	66.53	64.38	63.39	26.07	28.46	29.56
6	Papaya	77.60	65.03	63.33	13.77	27.74	29.63
7	Cuscuta	66.33	60.00	47.16	26.30	33.33	47.60
8	Eucalyptus	45.50	40.00	37.33	49.44	55.55	58.52
9	Control	90.00	90.00	90.00	0.0	0.0	0.0
	A (treatment)	B (doses)	A × B (interaction of treatment and doses)				
CD at 5%	0.21	0.12	0.36				
CV = 3.64							

but it had growth promotinal effect on fungus, as we kept on increasing the concentration of botanical extract, the fungal growth was also increased. Significant fungal inhibition was then observed by Cuscuta showing 26.30, 33.33 and 47.60% growth inhibition at 10, 20 and 30% concentrations, respectively. Marigold was also found effective over Guava, Papaya and Hibiscus showing inhibition percentage 28.88, 36.80 and 37.35%, 26.07, 28.46 and 29.56%, 13.77, 27.74 and 29.63% and 23.33, 25.44 and 26.80%, respectively. Neem was found least effective as compare to other botanicals showing percentage inhibition as 33.04, 26.66 and 24.80% in all concentrations and had growth promotional effect on fungus but it inhibited the sporulation of pathogen at increasing concentration (at 30%) which may be effective for control of secondary spread of pathogen in field and control the disease.

Hence, it can be concluded that plant extract of Eucalyptus, Cuscuta, Marigold and Duranta (at 10% conc.only) can be used for effective control of pathogen. The sequence of effectiveness of botanicals were as Eucalyptus> Duranta >Cuscuta >Marigold >Guava>Papaya>Hibiscus> Neem. Therefore, these botanicals have to be explored to use them in field to control Pokkah boeng disease of sugarcane. Synthetic fungicides generally used to protect the crops have become a popular target of conservationist and are considered to be important man made pollutants. The alternative choice may be use of botanical fungicides that are easily biodegradable, renewable and safe with minimal environmental impact [8]. The use of natural products as a supplement or an alternative to synthetic fungicide would reduce the indiscriminate application of plant protecting products, which has led to a number of resistant strains, besides pollution.

Crude extracts of neem (*Azadirachta indica*) leaf, neem seed and garlic (*Allium sativum*) at concentrations ranging from 5 to 30% completely inhibited the mycelial growth of *Fusarium oxysporum* f.sp.*lycopersici* [9]. Different plant extracts were also tried by different scientists [10,11], where they reported the inhibitory effect of these plant extracts to suppress the growth of different species of *Fusarium*. Some other plant extracts like *Parthenium hysterophorus, Aloe vera, Eucalyptus globosus, Calendula officinalis, Azadirachta indica* and *Ocimum sanctum* were tried on sugarcane for controlling red rot disease but not for Pokkah boeng. Therefore, it could be concluded that the plants in our surroundings can be exploited for non chemical management of the disease. On the other hand , the use of plant extracts may not be convenient way to use in crops being planted in large acreage as well as the delivery system of these plant extracts is also need to be considered. Therefore, further investigation in the direction will be needed to prove and strengthen the present findings.

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